Serial No. 10/010,646 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	X. HAN et al.	Examiner:	Hwa S. Lee
Serial No.:	10/010,646	Group Art Unit:	2877
Filed:	Nov. 13, 2001	Docket No.:	1010.8076U1
Title:	BIREFRINGENT MACH-ZEHNDER INTERFEROMETER		

CERTIFICATE UNDER 37 C.F.R. 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described herein, are being deposited in the United States Postal Service, as first class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450 on January 6, 2004.

Iain A. McIntyre
Name

Signature

AMENDMENT AND RESPONSE UNDER 37 C.F.R. §1.111

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This paper is submitted in response to the Office Action dated November 12, 2003, setting a three month shortened statutory period for response.

IN THE CLAIMS

A complete set of claims, showing current status, is presented below.

1. (currently amended) A birefringent interferometer for use with a polarized input light beam, comprising:

a first birefringent element oriented to split the polarized input light beam into a first polarized beam and a second polarized beam having a polarization direction orthogonal to a polarization direction of the first beam;

a second birefringent element oriented to combine the first and second polarized beams into an output beam; and

a polarization sensitive detector unit disposed to detect a selected polarization of the output beam

wherein the first birefringent element is oriented to receive the polarized input light beam along a z-direction, a y-direction is defined perpendicular to the z-direction and at 45° to the polarization direction of the polarized input light, an x-direction is defined orthogonal to both the y-direction and the z-direction, and the first birefringent element has an optical axis lying at a selected angle, θ, relative to the z-direction in the y-z plane defined by the y-direction and the z-direction, the second birefringent element having an optical axis lying at the negative of the selected angle, $-\theta$, relative to the z-direction in the y-z plane defined by the y-direction and the z-direction.

2. (original) A birefringent interferometer as recited in claim 1, further comprising a light source disposed to transmit the polarized input light beam to the first birefringent element.

3. (original) A birefringent interferometer as recited in claim 2, wherein the light source includes a light generator that generates a polarized output as the polarized input light beam.

4. (original) A birefringent interferometer as recited in claim 2, wherein the light source includes a light generator that generates an unpolarized output, the unpolarized output passing through a polarizer to produce the polarized input light beam.

5. (original) A birefringent interferometer as recited in claim 2, wherein the light source includes a broadband light generator.

6. (original) A birefringent interferometer as recited in claim 2, wherein the light source includes a laser.

7. (original) A birefringent interferometer as recited in claim 6, wherein the laser is a tunable laser.

8. (original) A birefringent interferometer as recited in claim 2, further comprising a controller coupled to control operation of the at least one of the light source and the detector unit.

9. (original) A birefringent interferometer as recited in claim 8, wherein the controller includes an analyzer unit coupled to the detector unit to record an output from the detector unit.

10. (original) A birefringent interferometer as recited in claim 8, further comprising an interface unit connected to the controller and couplable to a computer, the controller capable of operating under control instructions received from a computer coupled via the interface unit.

11. (original) A birefringent interferometer as recited in claim 1, wherein the polarization sensitive detector unit includes a polarizer disposed to select the selected polarization of the output beam from the second birefringent element.

12. (original) A birefringent interferometer as recited in claim 1, wherein the polarization sensitive detector unit includes a photodetector.

13. (original) A birefringent interferometer as recited in claim 12, wherein the polarization sensitive detector unit further includes a spectrometer disposed to disperse the selected polarization of the output beam before reaching the photodetector.

14. (original) A birefringent interferometer as recited in claim 12, wherein the polarization sensitive detection unit includes a light dispersing unit to disperse light received from the second birefringent element and the photodetector is a multiple channel photodetector disposed to detect multiple wavelengths of light dispersed by the light dispersion unit.

15-17 (canceled)

18. (original) A birefringent interferometer as recited in claim 1, wherein the first and second polarized beams are spatially separated by the first birefringent element so that the first polarized beam does not overlap the second polarized beam between the first and second birefringent elements.

19. (currently amended) A birefringent interferometer as recited in claim 1, wherein the first and second birefringent elements are separated along a direction parallel to a propagation direction of the ~~ordinary and extraordinary~~ first and second polarized beams so as to leave a gap between the first and second birefringent elements.

20. (currently amended) An interferometer, comprising:

polarization beam splitting means for splitting an incoming polarized light beam into first and second light beams of orthogonal polarization;

polarization beam combining means for combining the first and second light beams of orthogonal polarization into an output beam, polarization states of the first and second light beams being maintained between the polarization beam splitting means and the polarization combining means;

polarization sensitive detection means for detecting polarization of the output beam; and

wavelength selection means for selecting a wavelength of light detected by the polarization sensitive detection means.

21. (original) An interferometer as recited in claim 20, further comprising polarized light emitting means for emitting a polarized light beam as an input to the polarization splitting means.

22. (currently amended) A polarization interferometer, comprising:

a birefringent beam splitter having an input path and first and second output paths,

a birefringent beam combiner having first and second input paths and an output path, the first and second input paths of the birefringent beam combiner aligned respectively with the first and second output paths of the birefringent beam splitter, polarization states of light propagating along the first and second output paths respectively from the birefringent beamsplitter to the birefringent beam combiner remaining unchanged between the birefringent beamsplitter and the birefringent beam combiner; and

a polarization sensitive detector disposed on the output path of the birefringent beam combiner.

23. (original) A polarization interferometer as recited in claim 22, further comprising a polarized light source that transmits a polarized light beam along the input path of the birefringent beam splitter.

24. (original) A polarization interferometer as recited in claim 23, wherein the polarized light source includes a generator of a polarized light beam.

25. (original) A polarization interferometer as recited in claim 23, wherein the polarized light source includes a generator of an unpolarized light beam on the input path to the birefringent beam splitter and a polarizer positioned on the unpolarized light beam between the generator and the birefringent beam splitter.

26. (original) A polarization interferometer as recited in claim 23, wherein the polarized light source is a tunable light source and further comprising a controller to control an operational wavelength of the tunable light source.

27. (original) A polarization interferometer as recited in claim 22, wherein the polarization sensitive detector includes a photodetector disposed on the output path from the birefringent beam combiner and a polarizer disposed on the output beam path from the birefringent beam combiner between the birefringent beam combiner and the photodetector.

28. (original) A polarization interferometer as recited in claim 27, wherein the polarization sensitive detector further includes a light dispersing unit disposed between the birefringent beam combiner and the photodetector.

29. (original) A polarization interferometer as recited in claim 28, wherein the light dispersing unit includes a movable dispersing element, and further comprising a controller coupled to the light dispersing unit to control a position of the moveable dispersing element.

30. (original) A polarization interferometer as recited in claim 29, further comprising an interface unit connected to the controller and couplable to a computer, the controller capable of operating under control instructions received from a computer coupled via the interface unit.

31. (original) A polarization interferometer as recited in claim 28, wherein the photodetector is a multiple channel photodetector disposed to detect multiple wavelengths of light dispersed by the light dispersing unit.

32. (original) A polarization interferometer as recited in claim 22, further comprising a data analysis unit coupled to the polarization sensitive detector to analyze an output signal from the polarization sensitive detector.

33. (original) A polarization interferometer as recited in claim 32, further comprising a data display unit coupled to the data analysis unit to display data analyzed by the data analysis unit.

34. (original) A polarization interferometer as recited in claim 32, further comprising an interface coupled to the data analysis unit to interface to a computer.

35. (new) A polarization interferometer as recited in claim 22, wherein light propagating along the first output path from the birefringent beam splitter is an ordinary ray in the birefringent beam splitter and an extraordinary ray in the birefringent beam combiner and light propagating along the second output path from the birefringent beam splitter is an extraordinary ray in the birefringent beam splitter and an ordinary ray in the birefringent beam combiner.

36. (new) A polarization interferometer as recited in claim 22, wherein light propagating along the first output path from the birefringent beam splitter is an extraordinary ray in the birefringent beam splitter and an extraordinary ray in the birefringent beam combiner and light propagating along the second output path from the birefringent beam splitter is an ordinary ray in the birefringent beam splitter and an ordinary ray in the birefringent beam combiner.

REMARKS

Claims 1-14, and 18-34 are pending in the application. Claims 1, 19, 20 and 22 have been amended. Claims 15-17 have been canceled without prejudice or disclaimer. New claims 35 and 36 have been added. No new matter has been added. Reconsideration of the claims, in view of the comments provided below, is respectfully requested.

Applicants thank the Examiner for indicating that claim 16 contains allowable subject matter.

Claim Objections

Claim 19 was objected to for an informality. Claim 19 has been amended to remove the informality.

Rejection under 35 U.S.C. § 103(a)

Claims 1-19

Claims 1-11, 18 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,459,487) (Chen). Chen teaches a measurement system having a number of operative elements: a computer 10 with frequency period analysis software, a tunable laser 12 operated in a wavelength scanning mode by the computer 10 using scanning control algorithms, a polarization scrambler 14, an optical measurement bench 16, a power meter 18 to which the laser beam can be directed after the bench 16 at a junction 19 comprising a switch, fiber or splitter, and an optical spectrum analyzer 20 (col. 5, lines 36-46).

The optical measurement bench 16 consists of a series of polarization beam splitters, 1/2 waveplates and polarizers, as seen in both FIGS. 1 and 2, which show an input collimator 30, a polarizer 32 oriented at 45° to the horizontal, a first horizontal beam displacer 34, and a true zero order 1/2 waveplate 35 to rotate the polarization of the displaced e and o beams by 90° before one or more glass elements to be measured for optical path length. A second horizontal beam displacer 40 follows the windows 36, 37 to recombine the two beams. An output polarizer 42 is oriented at -45° to the horizontal (col. 5, line 56 – col. 6, line 32).

Claim 1 has been amended to include the limitations of claims 15 and 16. Claim 16 was indicated to contain allowable subject matter in the Office Action. Claims 15-17 have been

canceled. Therefore, claim 1 and claims 2-11, 18 and 19, which depend from claim 1, should now be allowable.

Claims 12-14 are rejected as being unpatentable over Chen in view of Brooks et al. (U.S. Patent No. 5,675,411) (Brooks). Since claims 12-14 depend from allowable claim 1, this rejection is moot and claims 12-14 are allowable.

Claims 20-26

Claims 20-26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,459,487) (Chen).

Three criteria must be met to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art reference, or combination of references, must teach or suggest all the claim limitations. MPEP § 2142. Applicant respectfully traverses the rejection since it would not be obvious for one of ordinary skill in the art to modify the reference in the manner suggested to obtain the claimed invention.

Independent claim 20 is directed to an interferometer that comprises polarization beam splitting means for splitting an incoming polarized light beam into first and second light beams of orthogonal polarization and polarization beam combining means for combining the first and second light beams of orthogonal polarization into an output beam. The polarization states of the first and second light beams are maintained between the polarization beam splitting means and the polarization combining means. Polarization sensitive detection means is provided for detecting polarization of the output beam and wavelength selection means is used for selecting a wavelength of light detected by the polarization sensitive detection means.

Independent claim 22 is directed to a polarization interferometer that comprises a birefringent beam splitter having an input path and first and second output paths and a birefringent beam combiner having first and second input paths and an output path. The first and second input paths of the birefringent beam combiner are aligned respectively with the first and second output paths of the birefringent beam splitter. Polarization states of light propagating along the first and second output paths from the birefringent beamsplitter to the birefringent beam combiner remaining unchanged between the birefringent beamsplitter and the birefringent beam

combiner. A polarization sensitive detector is disposed on the output path of the birefringent beam combiner.

Chen fails to teach all the elements of claims 20 and 22 and, in fact, teaches away from these claims. Chen teaches that the optical bench consists of a series of polarization beamsplitters, ½ waveplates and polarizers (col. 5, lines 56-57) and that the ½ waveplate (35) is a true, zero order ½ waveplate disposed between first horizontal beam displacer (34) and the second horizontal beam displacer (40). The ½ waveplate is used to rotate the polarization states of the light in the two light beams passing from the first horizontal beam displacer (34) to the second horizontal beam displacer (40) (col. 6, lines 10-13).

In the invention according to claim 20, the polarization states of the first and second light beams are maintained between the polarization beam splitting means and the polarization combining means. This contrasts with Chen in which the polarization states of the beams are rotated, and thus not maintained, on passing between the first horizontal beam displacer (34) and the second horizontal beam displacer (40).

In the invention according to claim 22, the polarization states of light propagating along the first and second output paths from the birefringent beamsplitter to the birefringent beam combiner remain unchanged between the birefringent beamsplitter and the birefringent beam combiner. Again, this contrasts with Chen in which the polarization states of the beams are rotated, and are therefore changed, on passing between the first horizontal beam displacer (34) and the second horizontal beam displacer (40).

Furthermore, since Chen states that the optical bench consists of the ½ waveplate, one would understand that the ½ waveplate must be present.

Chen failed to teach or suggest that the polarization interferometer can be made to operate without the use of a half-waveplate between the beam splitter and combiner. Omission of an element with retention of the Element's function is an indicia of unobviousness, *In re Edge*, 359, F.2d 896, 149 USPQ 556 (CCPA 1966), MPEP § 2144.04.II.B. According to Applicant's design, as claimed in claims 20 and 22, omission of the ½ waveplate, and thus maintenance of the polarization states between the splitter and combiner can still lead to the ordinary ray in the beam splitter being an extraordinary ray in the beam combiner, and the extra-ordinary ray in the beam splitter being an ordinary ray in the beam combiner. Thus, the function of the ½ waveplate is

maintained but the ½ waveplate itself is omitted. Accordingly, applicants believe that the inventions of claims 20 and 22 are patentable over Chen.

Dependent claims 21 and 23-26, which depend from claims 20 and 22 and further define the inventions of claims 20 and 22, were also rejected under 35 U.S.C. §103(a) as being unpatentable over Chen. While Applicants do not acquiesce with the particular rejections to these dependent claims, it is believed that these rejections are moot in view of the remarks made in connection with independent claims 20 and 22. Therefore, dependent claims 21 and 23-26 are also in condition for allowance.

Dependent claims 27-34

Dependent claims 27-34 are rejected as being unpatentable over Chen in view of Brooks. Brooks teaches a spectrometer that uses a fiber-optical transformer having an arcuate one-dimensional input region and a rectangular output region for illuminating the active area of a two dimensional sensor. The input region is coincident with a Rowland circle of the spectrometer (Abstract).

Brooks fails to rectify the deficiencies of Chen discussed above with respect to claim 22, and so claims 27-34 are also allowable.

Dependent claims 35 and 36

New claims 35 and 36 have been added and depend from independent claim 22. Support for claim 35 is provided in FIG. 6 and its description in the specification and support for new claim 36 is provided in FIG. 4 and its description in the specification. No new matter has been added.

Conclusion

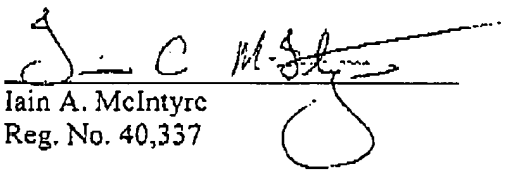
In view of the amendments and reasons provided above, it is believed that all pending claims are in condition for allowance. Applicant respectfully requests favorable reconsideration and early allowance of all pending claims.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's attorney of record, Iain A. McIntyre at (612) 436-9610.

Respectfully submitted,

CCVL
Customer No. 38846

Date: January 6, 2003

By: 
Iain A. McIntyre
Reg. No. 40,337

PTO/SB/122 (06-03)
Approved for use through 11/30/2005. OMB 0651-0035
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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Application

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Alexandria, VA 22313-1450.

Application Number	10/010646
Filing Date	November 13, 2001
First Named Inventor	X. HAN et al.
Art Unit	2877
Examiner Name	Hwa S. Lee
Attorney Docket Number	1010.8076U1

Please change the Correspondence Address for the above-identified patent application to:

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Address	225 South Sixth Street				
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I am the:

☐ Applicant/Inventor

☐ Assignee of record of the entire interest.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☑ Attorney or Agent of record. Registration Number 40,337

☐ Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number _____

Typed or Printed Name	Iain A. McIntyre
Signature	I. C. McIntyre
Date 01/06/2004	Telephone 612.436.9610

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*

☐ *Total of ___1___ forms are submitted.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

September 30, 2004

Time: 8:45 a.m.

TO: Commissioner for Patents
Attn: Ms. Tiffany Vines
Patent Examining Corps
Facsimile Center
P.O. Box 1450

Alexandria, VA 22313-1450

FROM: Iain A. McIntyre

OUR REF: 1010.8076U1

TELEPHONE: 571.272.1635

FAX NUMBER 571.273.1635

*** Please deliver to Examiner Lee in Art Unit 2877. ***

Document(s) Transmitted: **Communication Regarding Missing Amendment (1 pg.), Amendment (12 pages), Date-Stamped Return Postcard and transmittal (2 pages), Change of Correspondence (1 pg.), Fax Cover Sheet to Examiner Lee (August 19, 2004), and Confirmation of Fax Tranmission to Examiner Lee.**

Total pages of this transmission, including cover letter: 17 pgs.
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In re. Patent Application of: X. HAN et al.
Serial No.: 10/010,646
Filed: November 13, 2001
Title: Birefringent Mach-Zehnder Interferometer

Examiner: Lee, Andrew
Group Art Unit: 2877
Docket No.: 1010.8076U1

Please charge any additional fees or credit overpayment to Deposit Account No. 50-2886.

By: I. C. M. Stg
Name: Iain A. McIntyre
Reg. No.: 40,337

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Iain A. McIntyre

Sept 30, 2004
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Serial No. 10/010,646 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	X. HAN et al.	Examiner:	Hwa S. Lee
Serial No.:	10/010,646	Group Art Unit:	2877
Filed:	Nov. 13, 2001	Docket No.:	1010.8076U1
Title:	BIREFRINGENT MACH-ZEHNDER INTERFEROMETER		

COMMUNICATION REGARDING MISSING AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Examiner Lee called the below-signed attorney on August 19, 2004, and indicated that no response had been received to the Office Action dated November 12, 2003.

The below-signed attorney has reviewed the file and confirmed that a response to the Office Action was sent to the PTO on January 6, 2004, via first class mail. A copy of that amendment accompanies this communication, along with a copy of the return postcard received from the USPTO. The postcard is date-stamped January 9, 2004. Accordingly, Applicants' position is that an amendment was timely filed in response to the Office Action, and that the amendment was received by the PTO, as is confirmed by the return postcard. Applicants request that the amendment be entered in the case.

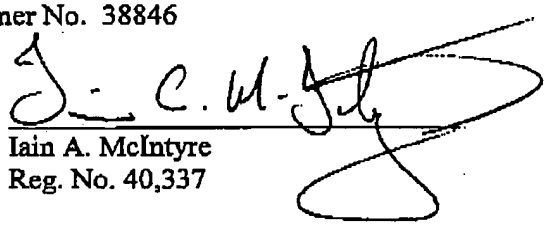
A copy of the Change of Correspondence Address, mailed with the amendment, is also attached. Kindly update the records of this case with the appropriate new contact information.

If there are any further questions regarding this Communication, the Examiner is invited to contact the below-signed attorney at (612) 436-9610.

Respectfully submitted,

CCVL
Customer No. 38846

Date: August 19, 2004

By: 
Iain A. McIntyre
Reg. No. 40,337

Receipt is hereby acknowledged for the following in the United States Patent and Trademark Office:

In re Patent Application of: X. HAN et al.
Title: Birefringent Mach-Zehnder Interferometer
Serial No.: 10/010646 Filing Date: November 13, 2001

CONTENTS: An Amendment and Response (12 Pages); Change of Correspondence Address (1 pg.); a Return Postcard and TRANSMITTAL SHEET.

Mailed: January 6, 2004
IAM/gb

Docket No.: 1010.8076U1
Due Date: February 12, 2004

Receipt is hereby acknowledged for the following in the United States Patent and Trademark Office:

In re Patent Application of: X. HAN et al.
Title: Birefringent Mach-Zehnder Interferometer
Serial No.: 10/010646 Filing Date: November 13, 2001

CONTENTS: An Amendment and Response (12 Pages); Change of Correspondence Address (1 pg.); a Return Postcard and TRANSMITTAL SHEET.

Mailed: January 6, 2004
IAM/gb

Docket No.: 1010.8076U1
Due Date: February 12, 2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: X. HAN et al.

Title: Birefringent Mach-Zehnder Interferometer

Docket No.: 1010.8076U1
Filed: November 13, 2001
Examiner: Hwa S. Lee

Serial No.: 10/010646
Due Date: February 12, 2004
Group Art Unit: 2877

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Iain A. McIntyre
Name

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Signature

(GENERAL)

August 19, 2004

Time: 10:35 a.m.

TO: Commissioner for Patents
Attn: Examiner Lee
Patent Examining Corps
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P.O. Box 1450
Alexandria, VA 22313-1450

FROM: Iain A. McIntyre

OUR REF: 1010.8076U1

TELEPHONE: 571.272.2419

FAX NUMBER 571.273.2419

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Examiner: Lee, Andrew
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Docket No.: 1010.8076U1

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By: I. A. McI.
Name: Iain A. McIntyre
Reg. No.: 40,337

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Serial No.: 10/010,646
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Examiner: Lee, Andrew
Group Art Unit: 2877
Docket No.: 1010.8076U1

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Name: Iain A. McIntyre
Reg. No.: 40,337

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